

REMARKS

As an initial matter, Applicants express gratitude to the Examiner for courtesies granted Applicants' attorney during the recent interview. Unfortunately, agreement was not reached during the interview. While the Examiner agreed that *Wettstein* teaches the air jets contact adjacent concavities as well, the Examiner believed that the additional teaching destroys the primary reference of *Livingood et al.*, which is believed to disclose a central air jet within the concavity. Therefore, the Examiner determined that this feature in *Wettstein* must be ignored, because it allegedly does not conform with the teachings of *Livingood et al.* However, Applicants assert that this is another reason why the publication of *Livingood et al.* and the patent to *Wettstein*, in combination or alone, do not disclose the patentable features of the claimed invention.

In order to establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior references, when combined, must teach or suggest all of the claim limitations. MPEP § 2142.

The Federal Circuit has recently stressed that "[o]ur case law makes *clear* that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is vigorous application of requirement for a showing of the teaching or motivation to combine prior art references". *In re Dembiczak*, 50 U.S.P.Q. 2d 1614, 1617 (Fed. Cir. 1999) (emphasis added). The Federal Circuit requires that the "showing ... be clear and

particular." Id. "Broad conclusory statements regarding the teaching of multiple references, standing alone, are not 'evidence'". Id.

This is precisely the case in the present matter. The Examiner has failed to point to specific information in either reference which would suggest the combination between the two references to teach the features of the claimed invention. The Examiner points to no factual basis for combining the two references. The Examiner only makes the broad conclusory statements that the two references "are from the same field of endeavor and/or analogous art, and the purpose disclosed by Wettstein would have been recognized in the pertinent art by Livingood et al." and that "[i]t would have been obvious at the time the invention was made to a person having ordinary skill in the art to employ in Livingood et al. a plurality of impingement orifices defined by tubes 11 for the purpose of achieving a desired heat exchange as recognized by Wettstein". However, these conclusions do not constitute factual findings as required by the Federal Circuit. As such, the Examiner fails to make any "particular findings regarding the locus of the suggestion, teaching, or motivation to combine the prior art references", as specifically required by the Federal Circuit. Id.

It appears the Examiner is reconstructing the claimed invention from selected pieces of prior art without the requisite motivation or suggestion. In particular, it appears that the Examiner is picking and choosing elements from each reference, while discarding specific teachings that don't support his position. However, this is impermissible. The Examiner has failed to provide any motivation to modify or combine the references in the manner suggested by the Examiner. The Examiner can not reconstruct the claimed invention from

selected pieces of prior art absent some suggestion, teaching, or motivation in the prior art to do so. *Uniroyal, Inc. v. Rudkin-Riley Corp.*, 5 USPQ2d 1434, 1438 (Fed. Cir. 1999).

In addition, there is no reasonable expectation of success for combination of the references in the manner suggested by the Examiner. Impingement cooling is known to be a very effective method of cooling in a wide variety of technical processes, such as blade or vane cooling in gas turbines. *Livingood et al.* is one of a plurality of studies in this field investigating the heat transfer parameters of impingement jets onto plane surfaces or surfaces having a curvature.

Livingood et al. discloses an experimental arrangement for studying the heat transfer characteristics of a *single* turbulent air jet impinging on the concave surface of a hemispherical shell. The Examiner concedes that it comprises a single shell with a constant wall thickness (see Figure 1, section A-A). *Livingood et al.* does not mention directing a plurality of impingement jets onto a wall with an impingement facing side having a plurality of concave hemispherical surfaces. Likewise, *Livingood et al.* does not disclose an opposed wall having a plane design.

Nevertheless, the Examiner alleges that "these parameters appear to be selected for convenience in the experiment". However, Applicants submit that this conclusion is incorrect. The parameters selected in the *Livingood et al.* study reflect the real facts in the area of the leading edge. A constant wall thickness is a characteristic feature of the shell of *Livingood et al.* and a constant or near constant wall thickness is the characteristic feature of the leading edge of a vane or blade. Therefore, *Livingood et al.* clearly refers to

impingement cooling of concave walls, characterized by constant thickness in all areas of the concavity.

The Examiner also alleges that "the heat transfer surface comprises more than a single concavity opposed to a planar surface of the vane blade". However, Applicants submit that this allegation is likewise incorrect. There is only a single concavity opposed to the region of the leading edge of a blade or vane. Moreover, there is no opposed planar surface in this region. Inside of the blade of the leading edge is formed a semicylinder, which longitudinally extends from the foot to the tip of the blade. And the outer wall side is shaped either identically to the inner side or similarly with a thickening in the center. But in no case is there a concavity (or more concavities) with an opposed planar surface.

Moreover, the *Livingood et al.* states that "The results of an experimental study of heat transfer characteristics... compare favorably with a similar correlation for the concave surface of a semispherical shell. Such a favorable comparison substantiates the semicylindrical correlation which is used in the design of turbine vanes and blades". Thus, in contrary to the Examiner's position, the wall thickness was not "selected for convenience", but rather the hemispherical design of the surface was selected to investigate the heat characteristics of an impinging jet in the real hemicylindrical design of the working environment. The hemispherical design is clearly defined as an exclusive experimental arrangement for simulating a real semicylindrical surface. Accordingly, the Examiner's reliance on *Livingood et al.* is misplaced.

Nevertheless, the Examiner maintains the position that *Livingood et al.* is properly combinable with *Wettstein*. With respect to the *Wettstein* reference, it is argued that "..."

plural air jets with corresponding cavities is well-known..." and "...Wettstein teaches to employ a plurality of concave surfaces on a turbine vane or blade to achieve a desired heat exchange". However, this allegation is incorrect. *Wettstein* neither demonstrates the arrangement of plural jets with corresponding concavities nor to employ a plurality of concave surfaces on a turbine.

As heat transfer is a function of wall thickness, there is a danger of inhomogeneous temperature distribution on the opposed side of the wall. Particularly in modern turbo machines, such as a gas turbine, inhomogeneous temperature distribution is highly unwelcome. Therefore, one having ordinary skill in the art would direct the impingement jets to the areas with the largest wall thickness, and consequently a lower heat transfer, such as the webs of a relief. One having ordinary skill in the art would NOT direct the impingement jets into the deepenings, the point with the smallest wall thickness, and therefore highest heat transfer. *Wettstein* teaches away from directing the impingement jets into the reliefs.

In particular, *Wettstein* discloses to direct a plurality of impingement jets onto the concave surface of the semicylindrical leading-edge of a blade, as shown in Fig. 6. *Wettstein* also discloses a wall to be cooled having an impingement facing side formed as a relief or as a ribbed wall, as shown in Fig. 3 and Fig. 4, respectively. But neither this relief nor the ribbed surfaces form concavities. The wall structure is characterized by a plurality of projecting humps or projecting ribs. For avoiding non-homogeneous heat transfer, the jets are either directed onto the humps (Fig. 3) or the jets are thickened in such a way to hit the projecting ribs (Fig. 4). The thickened jets hit the ribs much more

intensively than the distant ground of the channels between them. Therefore, *Wettstein* clearly teaches to force the intensive cooling into the projecting parts of the wall, where the wall is relatively thick, and to limit the mainly convective cooling to the recessed areas, where the wall is thick. Accordingly, *Livingood et al.* is not properly combinable with *Wettstein*.

Nevertheless, Applicants have amended Claim 1 to define that each impingement jet does not strike adjacent troughs. Because *Livingood et al.* relates to a single surface, there is absolutely no disclosure relating to ensuring that each impingement jet does not strike adjacent troughs. Likewise, *Wettstein* specifically illustrates, which reference to FIG. 4, that the impingement jet should hit adjacent troughs. Therefore, neither *Livingood et al.*, nor *Wettstein*, in combination or alone, teach the features of Claim 1.

It appears that the Examiner has viewed the instant application as a guide for modifying the cited art. However, it is well established that the use of the application under examination as a guide to modifying the cited art constitutes impermissible hindsight, and may not be used in rejection of the claims. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990). Accordingly, the Examiner has failed to establish a *prima facie* case of obviousness.

For at least the foregoing reasons, it is submitted that the present invention, as defined in independent Claim 1, and the claims depending therefrom, is patentable distinguishable over the applied documents. Accordingly, withdrawal of the rejections of record and allowance of this application are earnestly solicited.

Should any questions arise in connection with this application, or should the Examiner believe that a telephone conference with the undersigned would be helpful in resolving any remaining issues pertaining to this application, the undersigned respectfully requests that she be contacted at the number indicated below.

Respectfully submitted,

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Marked-up Claims 1, 2, 5 and 6

1. (Amended) An impingement flow for a wall part [(3)], in which a plurality of impingement orifices [(2)] are arranged areally in a plane or curved carrier [(1)], the carrier being arranged at a distance from the wall part, and the impingement area, to be cooled or heated, of the wall part [(3)] being designed as a relief, wherein

- that side of the wall part [(3)] which faces the impingement jet is provided with a number of troughs [(4)] arranged next to one another, [at least] said troughs being in the form of spherical cups or similar rotationally symmetrical forms, one impingement jet per trough [(4)] being provided, which impingement jet strikes the trough base at least approximately perpendicularly and does not strike adjacent troughs, and

- that side of the wall part [(3)] which is remote from the impingement jet is of at least roughly plane design.

1 2. (Amended) The impingement flow as claimed in claim 1, wherein the
2 trough [(4)] has the shape of a circle segment or of a base area related thereto.

1 5. (Amended) The impingement flow as claimed in claim 1, wherein the wall
2 part [(3)] to be cooled or heated is made together with the troughs [(4)] as a casting].

1 6. (Amended) The impingement flow as claimed in claim 1, wherein the
2 impingement orifices [(2)] form the inlet [(2)] of impingement tubes [(21)], the mouth
3 [(23)] of which is directed toward the wall part [(3)] to be cooled or heated.